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Title: MaRIE: A facility for dynamic materials science at the mesoscale

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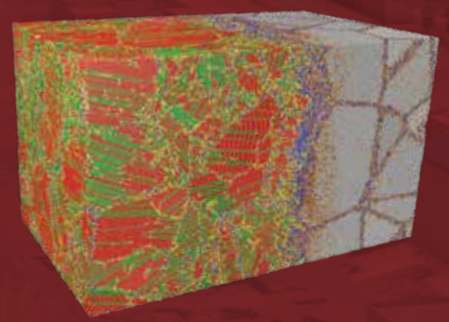
MaRIE: A FACILITY IN THE MAKING

The Matter-Radiation Interactions in Extremes (MaRIE) experimental facility will be used to discover and design the advanced materials needed to meet 21st-century national security and energy security challenges. MaRIE is the proposed experimental facility for time-dependent control of dynamic materials performance for national security missions. Specifically, MaRIE will provide the tools scientists need to develop and manufacture next-generation materials that will perform predictably and with controlled functionality in extreme environments.



MaRIE: A FUTURE FACILITY FOR FUTURE SCIENTISTS

MaRIE will revolutionize materials in extremes, addressing the grand challenge of observation to control of the time-dependent properties of materials that affect materials performance, while accelerating the qualification, certification, and assessment of materials in mission-critical applications. MaRIE as a national user facility will enable Los Alamos National Laboratory to attract the best and the brightest scientists across a broad range of disciplines.

marie.lanl.gov

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NNSA
National Nuclear Security Administration

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MaRIE will provide the nation's future stewards with the tools needed to support national security missions.
Above: Molecular dynamics simulations calculate phase transition dynamics for the shock loading of iron.

Each summer, the Laboratory anticipates approximately 1,200 high school, undergraduate, and graduate students from schools around the world. They will have a research experience beyond expectation at the Lab.

Los Alamos
NATIONAL LABORATORY
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MaRIE

A FACILITY FOR DYNAMIC MATERIALS SCIENCE AT THE MESOSCALE

Matter-Radiation Interactions in Extremes, Los Alamos National Laboratory's proposed flagship experimental facility to meet Dynamic Mesoscale Materials Science Capability needs.

LOS ALAMOS: A HISTORY-MAKING LAB SOLVING SCIENTIFIC GRAND CHALLENGES

Throughout its 75 years, Los Alamos National Laboratory has a proud history of its scientists solving the scientific and technical grand challenges of national security.

Materials science is a key capability pillar supporting the Laboratory's mission—from discoveries instrumental in ending World War II to ensuing advances in understanding nuclear materials, developing insensitive high explosives, and creating materials for fusion reactions, radiation casings, and neutron sources.

To meet new and emerging national security issues the Laboratory is stepping up to meet another grand challenge—transitioning from observing to controlling a material's performance. This challenge requires the best of experiment, modeling, simulation, and computational tools. MaRIE is the Laboratory's proposed flagship experimental facility intended to meet the challenge.

For more than 75 years, Los Alamos has provided world-leading, innovative, and agile materials solutions for national security missions.

CHOOSE MaRIE TO MAKE YOUR MARK

The MaRIE project seeks talented and motivated individuals to join the team making this facility a reality.

The Laboratory's postdoctoral program offers opportunities to perform research in a robust scientific R&D environment, to present and publish research, to advance knowledge in basic and applied science, and to strengthen national scientific and technical capabilities. Our Darleane Christian Hoffman Fellowship, named after the distinguished Los Alamos nuclear scientist and recipient of the U.S. National Medal of Science, recognizes, encourages, and rewards outstanding scientific and engineering contributions by women.

To meet its mission of solving national security challenges through scientific excellence, the Laboratory relies on scientists, engineers, technologists, and operational and administrative staff.

www.lanl.gov/postdocs
www.lanl.gov/careers/career-options/jobs/index.php

MaRIE: ACCELERATING OBSERVATION & ACHIEVING CONTROL AT THE MESOSCALE

Los Alamos National Laboratory has a long and distinguished history in lasers, free-electron lasers, and high-power accelerator technology. Key technologies originally developed at the Laboratory enabled the free-electron x-ray laser facilities in use worldwide today. Our researchers are developing the next generation of such probes, one focused on the middle scale between atomic structure and engineering continuum called the mesoscale. MaRIE will have the ability to produce a movie over time scales of nanoseconds to microseconds through multi-granular samples of material undergoing a dynamic event.

The sophistication of modeling and simulation will be enhanced not only by the wealth of data available from MaRIE, but also by the increased computational capacity made possible by the advent of exascale computing. This will allow for an unparalleled capability to understand, predict, and control materials behavior under extreme conditions.

MaRIE: CAPABILITIES

Leveraging the Los Alamos Neutron Science Center's (LANSCE) existing 1-MW, 0.8-GeV proton accelerator, MaRIE will bring together:

- the world's highest energy (42-keV) x-ray free-electron laser with gigahertz (few pulses) repetition ability, optimized for making time-dependent measurements in extreme environments;
- a Multi-Probe Diagnostic Hall (MPDH), in which materials under extreme dynamic loading conditions are simultaneously illuminated with hard, coherent, brilliant x-ray photons and radiographed with protons and/or electrons and other probes; and
- a Making, Measuring and Modeling Materials (M4) facility for materials synthesis and characterization with collo-cated high-performance computational co-design and data visualization tools focused on the mesoscale.

CHOOSE LOS ALAMOS TO MAKE A LIFETIME

Los Alamos consistently ranks as one of the "Best Small Towns"* in the country. Our community is a place of ancient village sites, spectacular scenery, diverse wildlife, uncommon high-altitude recreational opportunities, small-town friendliness, world-class cultural activities, fascinating history, and world-changing technology development.

While at work enjoy

- flexible work schedules; a casual but challenging work environment; a comprehensive benefits package; and health and wellness programs.

While at play enjoy

- the great outdoors, including skiing, hiking, and biking minutes from your office; and the cultural and entertainment possibilities in nearby Santa Fe, a city with an international reputation for southwest culture, arts, and cuisine.

www.lanl.gov/careers/life-at-lab/work-life-balance.php

*Livability.com 2013, 2014, 2015, 2016

Science on the roadmap to MaRIE is underway at Los Alamos National Laboratory: (from left) Scientists inspect a graphite mold used to cast plutonium "pucks" with specific microstructures; replace the proton-to-light converting scintillator in preparation for a dynamic experiment at LANSCE's Proton Radiography Facility, and examine interfaces in a simulation of deformed nanomaterials.

The enchanting surroundings, extraordinary people, and rich history make Los Alamos so much more than just a place to do great work.